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August 27, 1982

FRBSF Weekly Letter

Pricing Federal Irrigation Water

Forecasts of California's water supply and demand to the year 2000 predict ample overall supplies but an uneven geographic distribution of those resources. These studies warn of chronic shortages for some naturally arid areas, especially southern California, by the late 1980's. Most responses to this problem call for expanding the supply of water by building new dams and canals, but an alternative approach could be to reduce the projected demand for water by reforming the existing pricing system.

In California, agriculture uses about 85 percent of the total water consumed annually. Forty percent of this agricultural water is supplied by the Central Valley Project (CVP) and sold at wholesale by the federal Bureau of Reclamation. The water is purchased by irrigation districts and other utilities which in turn sell the water at retail to farmers. Thus the pricing of federal irrigation water has a direct effect on the ultimate demand for water in California. This *Letter* will describe the existing pricing practices and propose more efficient alternative methods. It concludes with a discussion of some implications of higher water prices for the demand for irrigation water and the future development of the CVP system.

Water subsidies

The Bureau is currently receiving an average of about $5.09 for each acre-foot of CVP irrigation water. This price recovers the annual cost of operation and maintenance and some of the cost of plant and equipment (valued at their original cost), but still represents a substantial subsidy to farmers.

The actual average cost of the CVP water is about $24 per acre-foot when calculated using the model prescribed by regulatory commissions for private investor-owned utilities and assuming, as in the case of the CVP, that the investment in facilities is financed solely through long-term debt. This "full historical" average cost consists of annual operation and maintenance costs, steady amortization of debt, interest and property taxes divided by the number of units of water expected to be sold in a given period.

The difference between the historical average cost and the price realized results from a number of public subsidies. The Reclamation Act of 1902 required water users to repay the construction costs of federal irrigation projects but not the interest on that investment. This interest subsidy amounts to the average rate paid by private utilities for new bond issues, which for Aaa public utility bonds has ranged from an average yield of 2.6 to 15.6 percent over the 1948-81 period.

The Reclamation Act of 1936 further limited farmers' obligations to their "ability to pay." Under this concept, the Bureau subtracts from the increased gross income attributable to project water the increase in non-water costs required to boost farm yields. The non-water costs, as calculated by the Bureau, include additional operating and capital costs and a rate of profit projected to be sufficient to encourage the farmer to increase farm yields. The Bureau then charges the irrigation district its estimates of the cost of service or the "ability to pay" price, whichever is lower. Reclamation law allows the Bureau to shift part of any shortfall to other water users, e.g., municipalities and electric power customers.

In addition, the Bureau offers irrigation districts long-term purchase contracts with rates fixed for specific periods of time, usually 40-years. These fixed rate contracts do not allow recovery of increased operational, maintenance and new-facility costs as these occur. The Bureau also does not pay, and therefore pass on, local property taxes. This contrasts with private water utilities in California for which property taxes averaged 2.6 percent of their total annual plant investment between

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1960 and 1977 and 1.7 percent during the 1978-81 period after the passage of Proposition 13.

Finally, the Bureau, while required by law to repay each dollar appropriated by Congress for investment in irrigation facilities within 50 years after the first delivery of water, has not repaid such borrowings systematically. In some years, its low rates have not even recovered annual operating and maintenance costs, also required by law. As a result, the Bureau has been forced to extend the repayment life for all CVP irrigation facilities each time new facilities were added.

With adjustments made for imputed property taxes, amortization and interest costs, the CVP actually incurred full average unit costs, on an historical accounting method, of at least $23.77/acre-foot of irrigation water in 1981. This means the general taxpayer provided a total estimated annual subsidy of $77 million for 1981, and of $966 million on a cumulative basis for the life of the project, 1948-1981.

Average replacement cost

The historical (original) average cost pricing method, while a traditional way of recovering capital costs, under-estimates the value of resources in periods of rapid inflation. In such periods, the replacement cost of existing plant and equipment is far higher than the original cost of that equipment. Pricing irrigation water at the average replacement cost of supplying that water would capture the increased value.

The replacement value of the CVP is estimated to be $1.7 billion. This is the aggregate value of past plant investments in 1981 dollars. The replacement value divided by the total acre-feet of water delivered in 1981 yields the average replacement cost of $48/acre-foot. Using this measure of average cost, which includes the true costs to society embodied by the CVP, yields a total subsidy of nearly $175 million in 1981 alone.

Expansion costs

In economic theory, the appropriate pricing method when the scale of a production plant is to be increased is by long-run incremental cost. This pricing practice makes customers aware of the economic value of the resources required to supply the additional increments, and provides them with the proper price signals for efficient choices among different expenditures. In the case of the CVP, this cost is the cost of supplying water with the next block of new storage and conveyance facilities scheduled to be added.

One of the additions to the Central Valley Project under consideration is the proposed Auburn-Folsom South Unit which consists of a dam, canal and several smaller structures. We have estimated the long-run incremental cost of this Unit by first discounting the future stream of annual costs (in 1981 dollars) by 10 percent, the real rate prescribed by the Office of Management and Budget for evaluating Federal projects. This calculation yields the present value of all costs of the addition over its life. Second, we multiplied the present value by the real rate of interest to arrive at the real annual cost of investing resources in this project rather than using them elsewhere. Third, we divided this annual cost by the project's expected annual output for an estimated long-run incremental cost of $324/acre-foot.

The high long-run incremental cost of water in California suggests two problems. First, average cost pricing even without subsidies obscures the cost of adding additional capacity because it blends or averages the cost of old and new capacity. Incremental cost pricing in contrast reflects only the higher cost of the new capacity required to increase the supply of water. Second, the present highly subsidized prices may have spurred consumption beyond the growth that would otherwise have occurred. In other words, standard economic analysis indicates agricultural benefits have not warranted the amount of resources devoted to the construction of the Federal irrigation system in California.

Watering less

If efficiency of resource allocation were the only criterion, the Bureau of Reclamation should price all irrigation water from the Central Valley Project on the basis of long-run incremental cost. However, the resulting high price would not only greatly shrink water usage but also the size of California's agricultural sector. Moreover, present regulations enjoin public utilities from making a profit, the result of long-run incremental costs exceeding the average costs of supplying water.

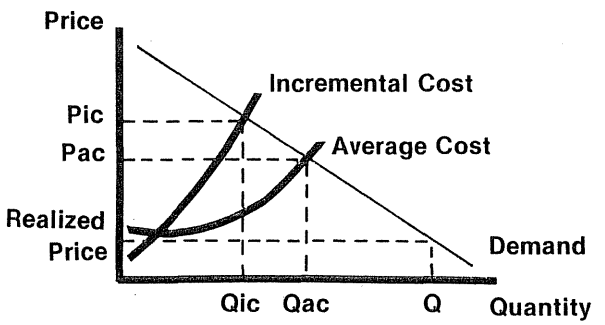
The second-best option from an efficiency standpoint is to price irrigation water at the average replacement cost. This method would at least recover the cost of resources already embodied by the system and enable the Bureau to generate enough revenue to perpetuate the existing capacity. It would eliminate the substantial subsidies now in effect.

Pricing on the basis of average replacement cost would make consumers aware of the resources already expended and give farmers a much stronger incentive to conserve water. Empirical studies show that the demand for irrigation water responds significantly to price changes where retail prices exceed $20/acre-foot. One study found that between $25 and $35/acre-foot, a 1 percent increase in price would result in a 1.5 percent decrease in consumption. Given a demand of 3.8 million acre-feet at $25 per acre-foot, a ten percent price rise would reduce the quantity demanded by 570,000 acre-feet, sufficient to eliminate the need for the proposed Auburn-Folsom project.

Sharply higher water prices might induce farmers to use less water by reducing output or adopting more efficient irrigation methods. They might also cause farmers to shift to less water-intensive crops or to withdraw land from irrigation. Water costs make up a relatively large proportion of the total production costs of field crops such as hay, wheat, and corn. On the other hand, water costs comprise a relatively small percentage of the total costs of tomatoes, peaches, lettuce, grapes, and nuts. In response to higher water prices, farmers might move toward specialty crops such as the latter. They also would probably use less water on hay, wheat, and corn because California's farmers have too small a share of the total domestic production of these field crops to raise market prices and pass added water costs onto consumers.

The social objective of developing the arid West may no longer be an appropriate reason for subsidizing agricultural water prices. Recent Congressional debate on reform of reclamation law has focused on the size of farms that should receive subsidies. With households and energy producers competing with farmers for water, Congress should logically give more attention to the role of the price mechanism in reducing the projected growth of demand for irrigation water.

Yvonne Levy



PRICING IRRIGATION WATER TO REDUCE DEMAND AND RECOVER COSTS

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BANKING DATA—TWELFTH FEDERAL RESERVE DISTRICT

(Dollar amounts in millions)

Selected Assets and Liabilities Large Commercial Banks	Amount Outstanding 8/11/82	Change from 8/4/82	Change from year ago Dollar	Change from year ago Percent
Loans (gross, adjusted) and investments*	160,803	– 72	9,376	6.2
Loans (gross, adjusted) — total#	140,736	– 348	10,395	8.0
Commercial and industrial	44,585	59	4,953	12.5
Real estate	57,277	79	3,354	6.2
Loans to individuals	23,390	– 33	493	2.2
Securities loans	2,607	– 183	1,281	96.6
U.S. Treasury securities*	6,452	225	305	5.0
Other securities*	13,615	51	– 1,324	– 8.9
Demand deposits — total#	39,293	–1,467	– 1,038	– 2.6
Demand deposits — adjusted	27,573	– 142	– 1,292	– 4.5
Savings deposits — total	30,861	– 159	859	2.9
Time deposits — total#	98,818	– 429	13,517	15.8
Individuals, part. & corp.	89,458	– 371	12,357	16.0
(Large negotiable CD's)	37,052	– 375	2,046	5.8

Weekly Averages of Daily Figures	Week ended 8/11/82	Week ended 8/4/82	Comparable year-ago period
Member Bank Reserve Position			
Excess Reserves (–)/Deficiency (–)	– 212	94	58
Borrowings	79	76	60
Net free reserves (–)/Net borrowed(–)	– 291	18	– 2

* Excludes trading account securities.
# Includes items not shown separately.

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